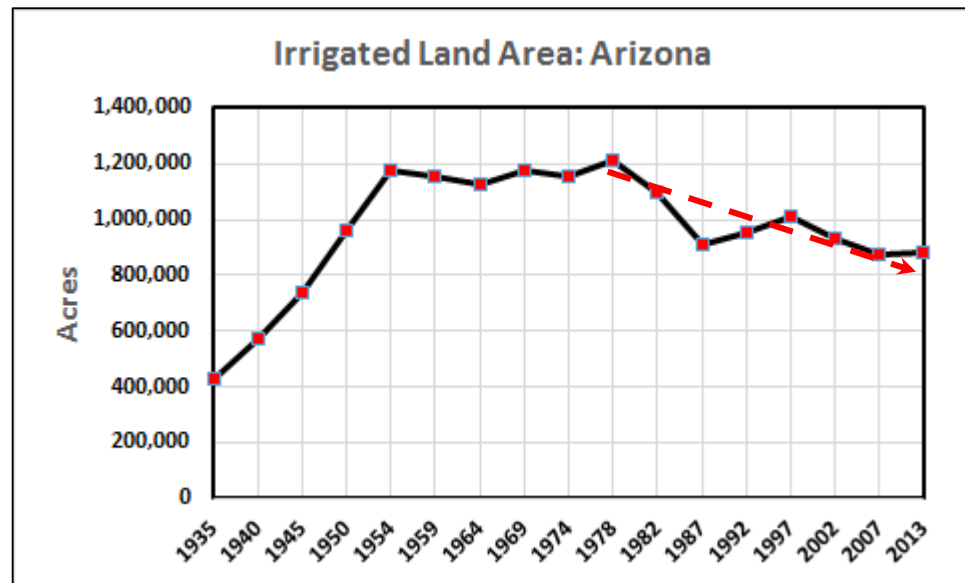


Agricultural Water Use

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Associate Director, Agriculture & Natural Resource Programs
Arizona Cooperative Extension, College of Agriculture & Life Sciences
University of Arizona

Factors Impacting Agricultural Water Use

- Irrigated Acres
- Cropping Systems
 - Type of crop
 - Season/season length
 - Double vs single crop
- Irrigation Management & Efficiency

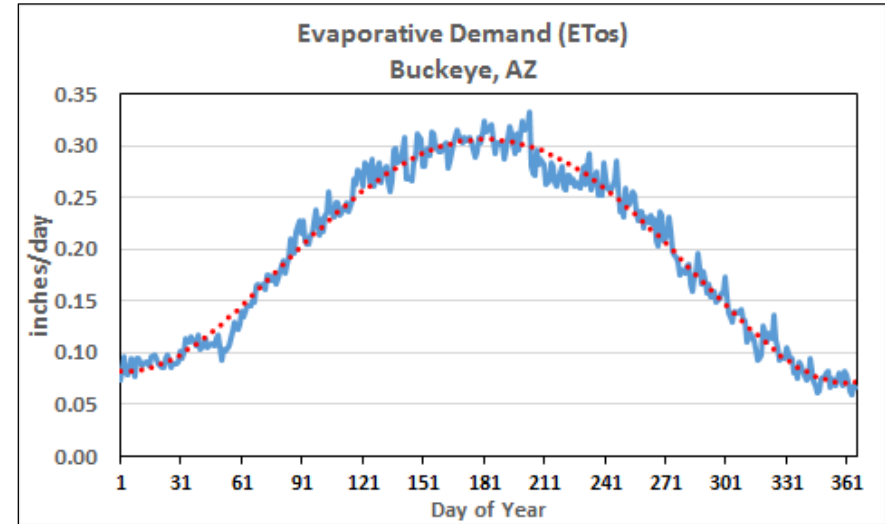


Source: Census of Agriculture

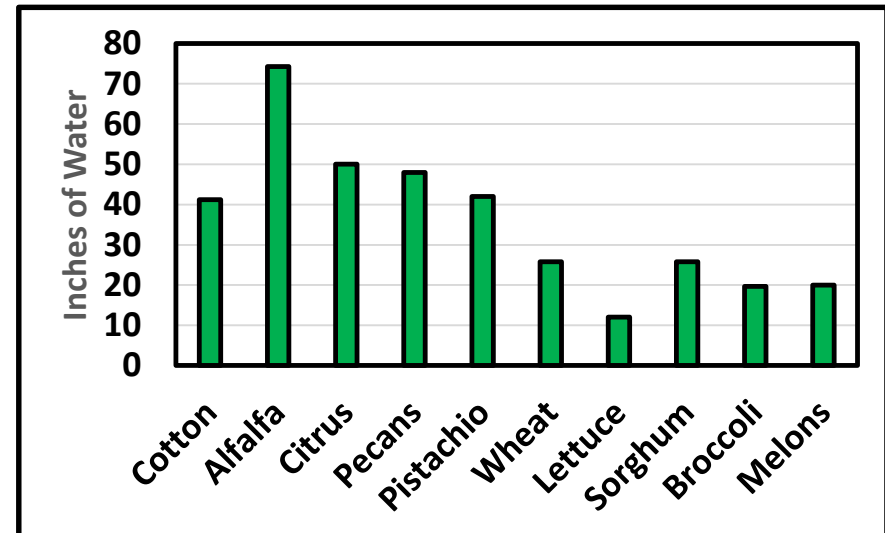
Decreased ~10,000/acres/yr since 1978

Growing Season & Crop Water Use

- **Evaporative Demand**
 - 4-fold seasonal change
 - Peak in late June/early July
 - Minimum: Dec/Jan
- **Crop Water Requirements**
 - Reflect growing season
 - Vary ~15% across AZ
 - Double cropping
 - Vegetables/wheat
 - Highest
 - Perennial/summer crops
 - Lowest
 - Winter/shoulder season crops



Source: Arizona Meteorological Network



Sources: Erie et al. 1981; recent research by Brown, Walworth, Papuga, Sanchez



12% of Ag
Elevation: 400-3000'
Rain: 4-8"
Surface Water (CO River)
Groundwater ("Inland")

Southwest AZ

25% of Ag
Elevation: < 600'
Rain: <4"
Surface Water

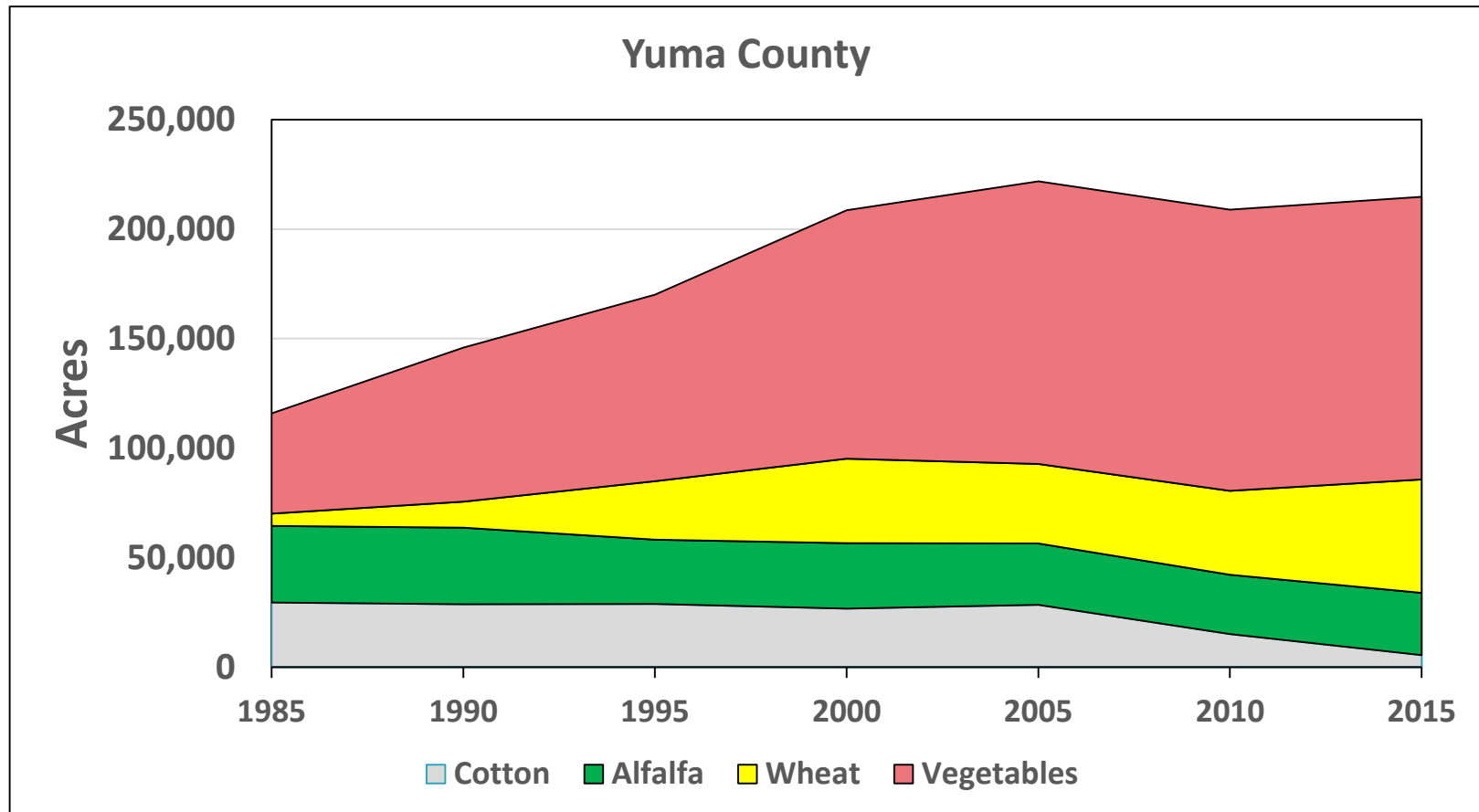
Central AZ

51% of Ag
Elevation: 600-3000'
Rain: 4-12"
Ground/Surface Water

Southeast AZ

12% of Ag
Elevation: 3000-4400'
Rain: 10-16"
Surface Water (Gila V)
Groundwater (Cochise Co.)

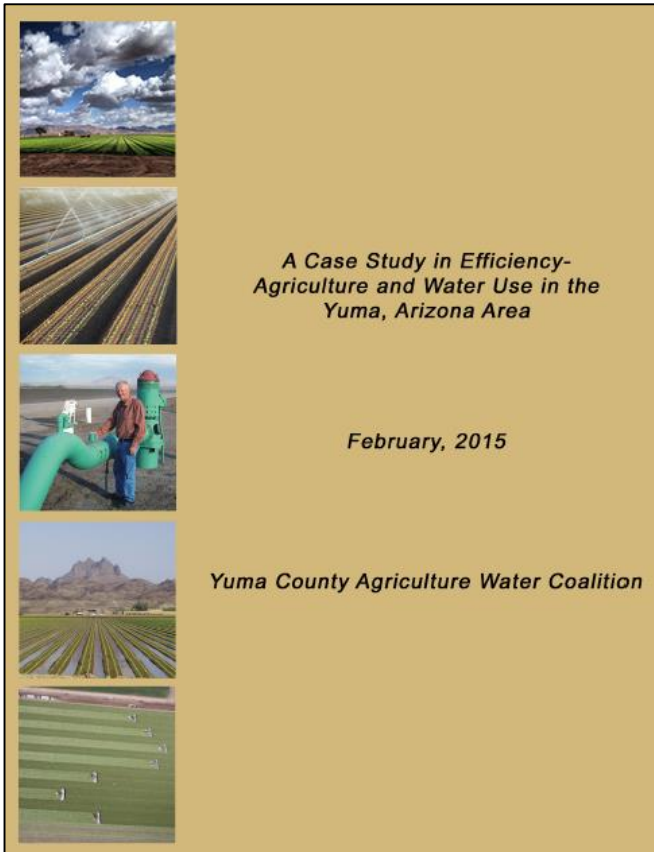
Cropping Trends: Southwest AZ



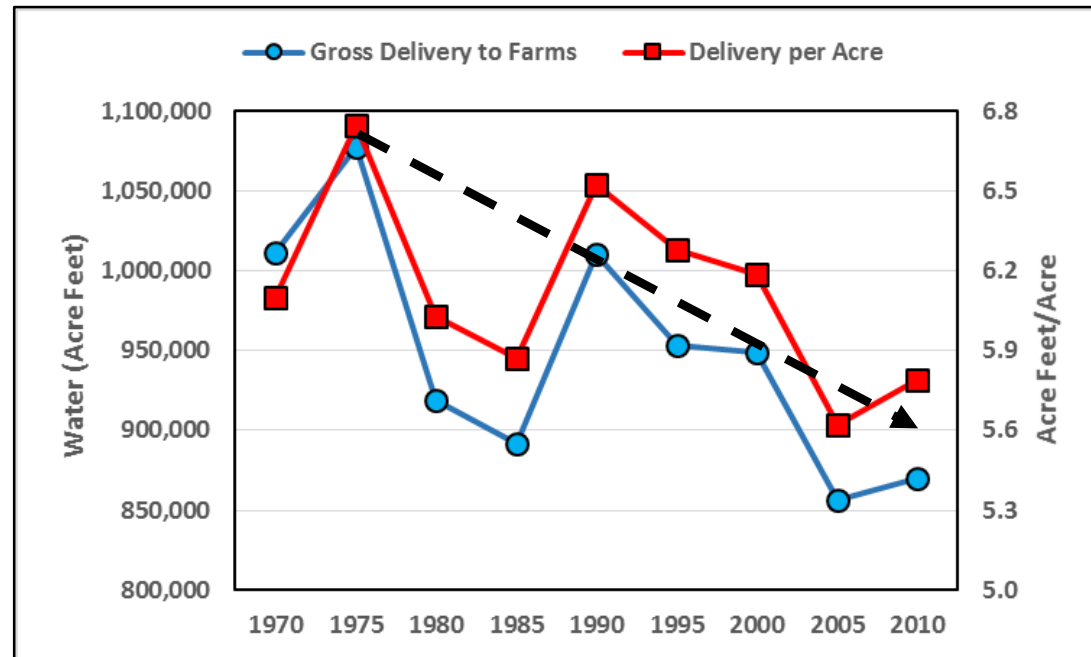
Source: National Agricultural Statistics Service & Yuma irrigation districts

Now dominated by vegetable production; durum wheat often double cropped with vegetables

Yuma County Agriculture Water Coalition

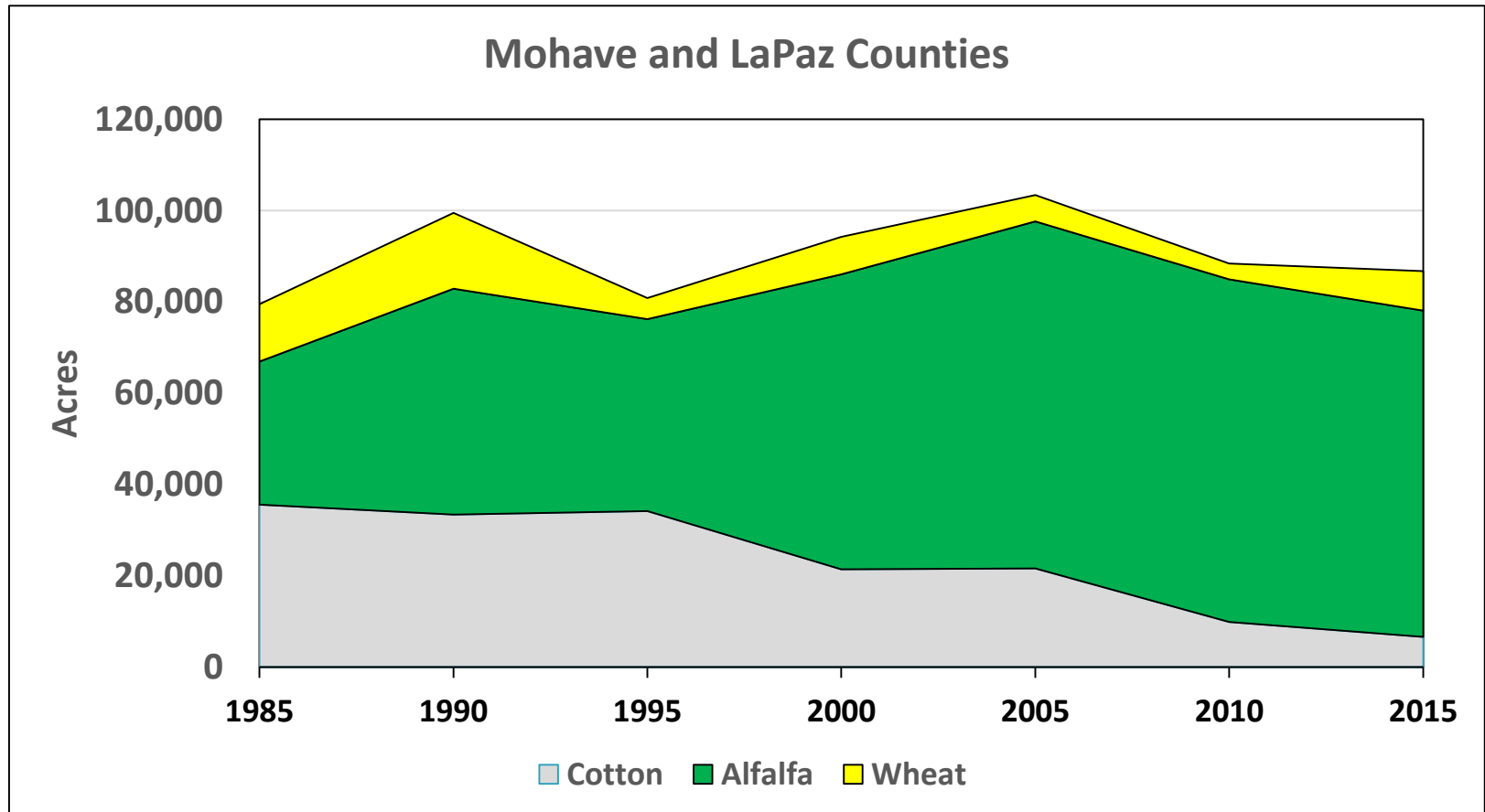


Source: <http://www.agwateryuma.com/>



Switch to winter-centric production focused on vegetable and durum wheat has reduced water use ~19% since 1975

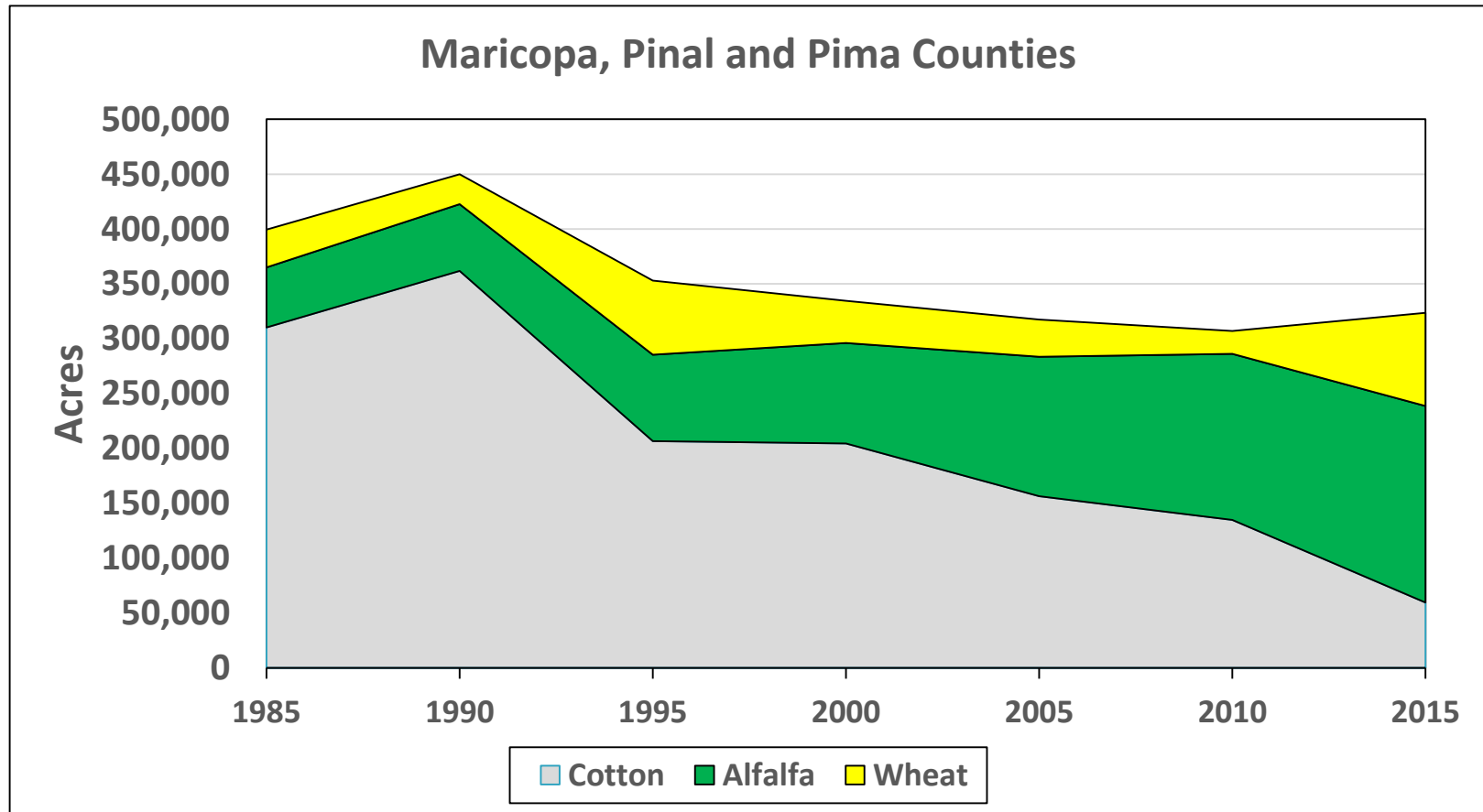
Cropping Trends: Northwest AZ



Source: National Agricultural Statistics Service

Significant shift to alfalfa production; majority of irrigated land on CRIT & FMIT land

Cropping Trends: Central AZ

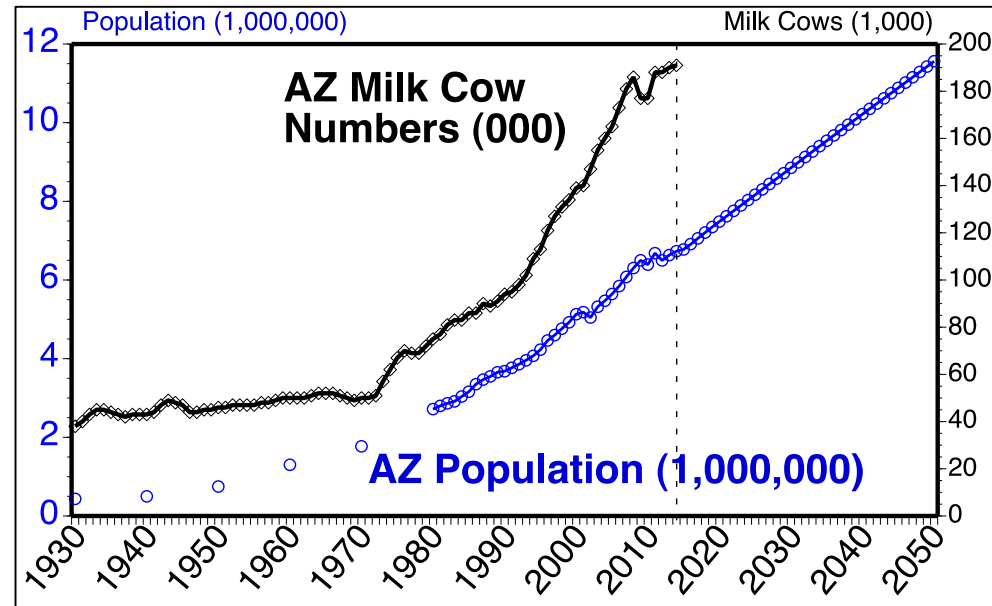


Source: National Agricultural Statistics Service

**Dramatic reduction in cotton production; increased acres devoted to alfalfa, corn/sorghum silage and wheat .
Corn & sorghum silage now estimated at 50,000 acres (not shown on graph).**

Increased Forage Production

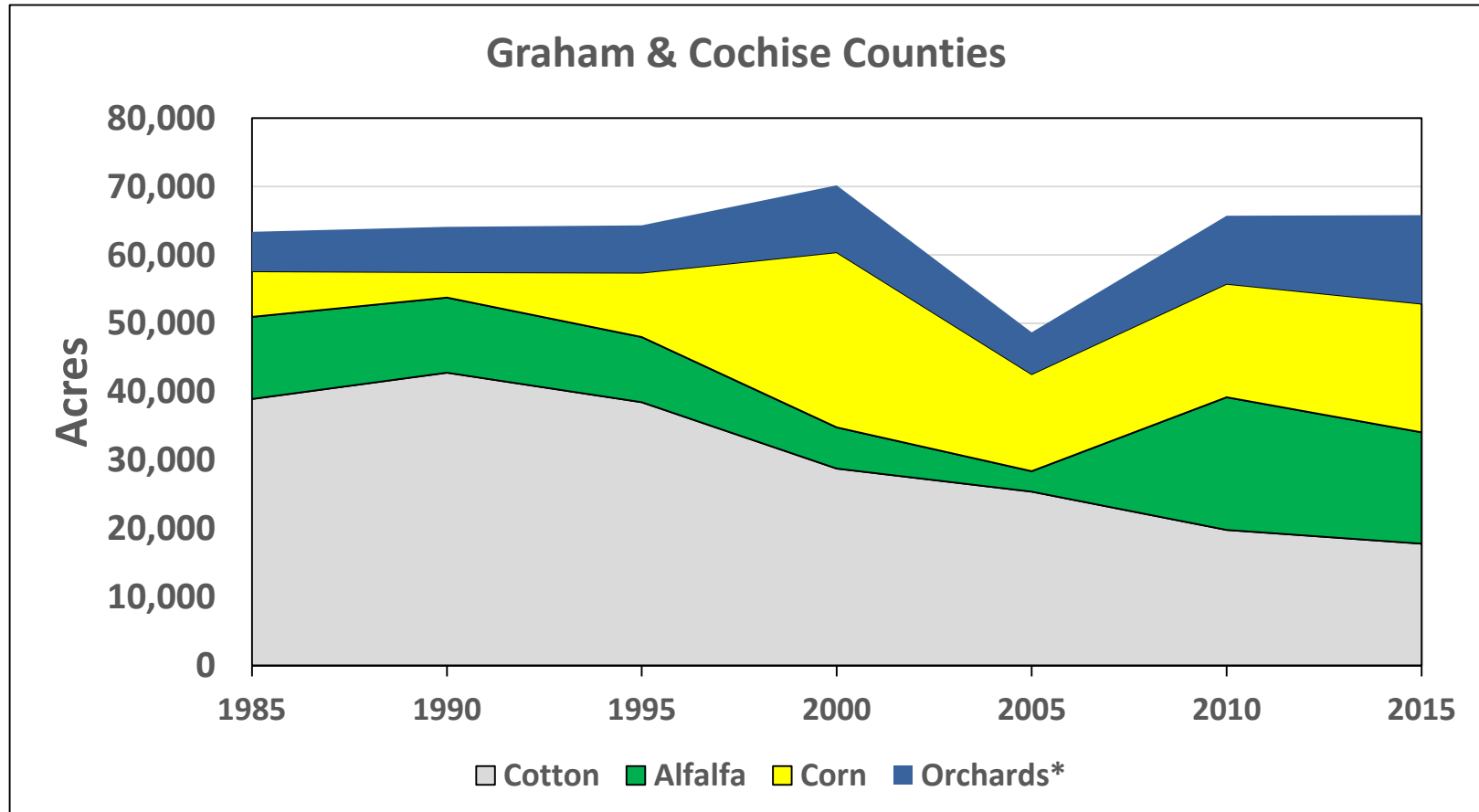
- **Forages replacing cotton**
 - **More profitable**
 - **Higher water use**
 - Alfalfa: 60"+
 - Cotton: 32-42"
- **Growing animal demand**
 - **193,000 dairy cows***
 - **173,000 horses**
 - **279,000 cattle on feed**
- **Proximity important**
 - **Transport costs**



Graph courtesy of Dr. Russ Tronstad, Extension Economist, Univ. of AZ

* ~160,000 acres of alfalfa required for AZ dairies

Cropping Trends: Southeast AZ



Source: National Agricultural Statistics Service; *2015 data for orchards estimated

Significant reduction in cotton; expanded production of nut trees, corn and alfalfa

Southeast Arizona Tree Nut Production



Mature Pecan Orchard

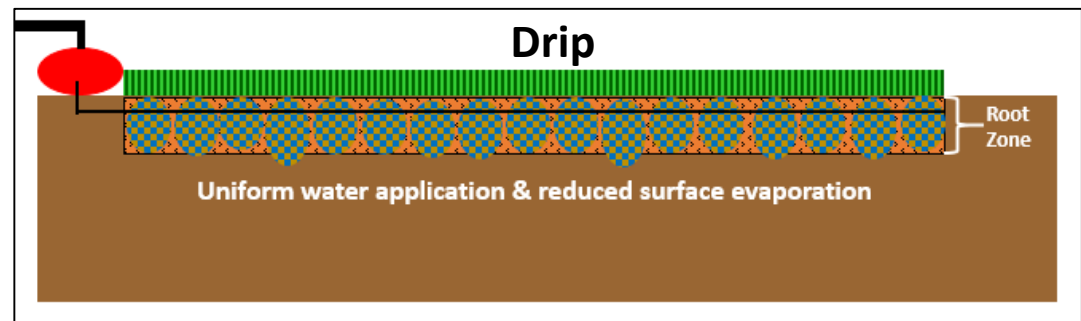
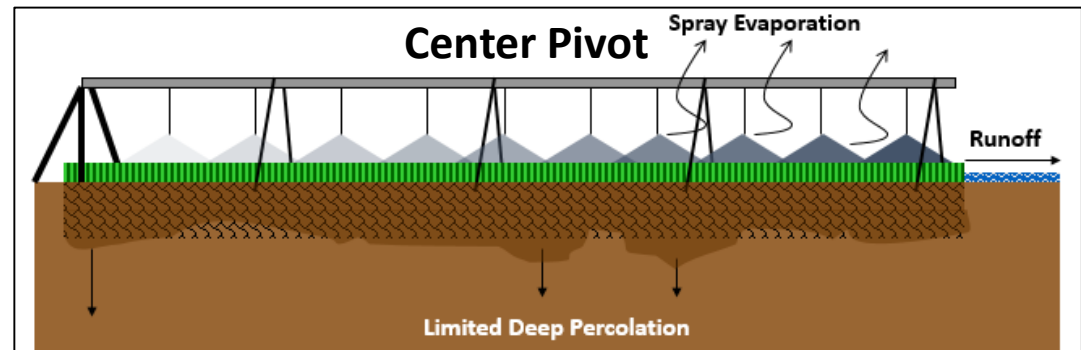
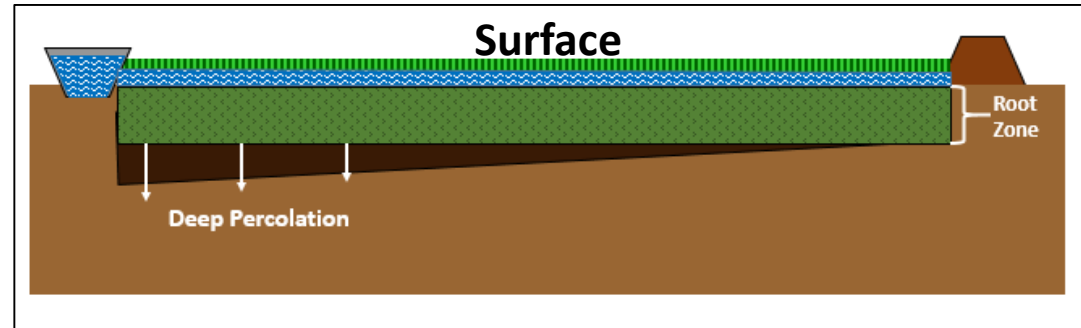
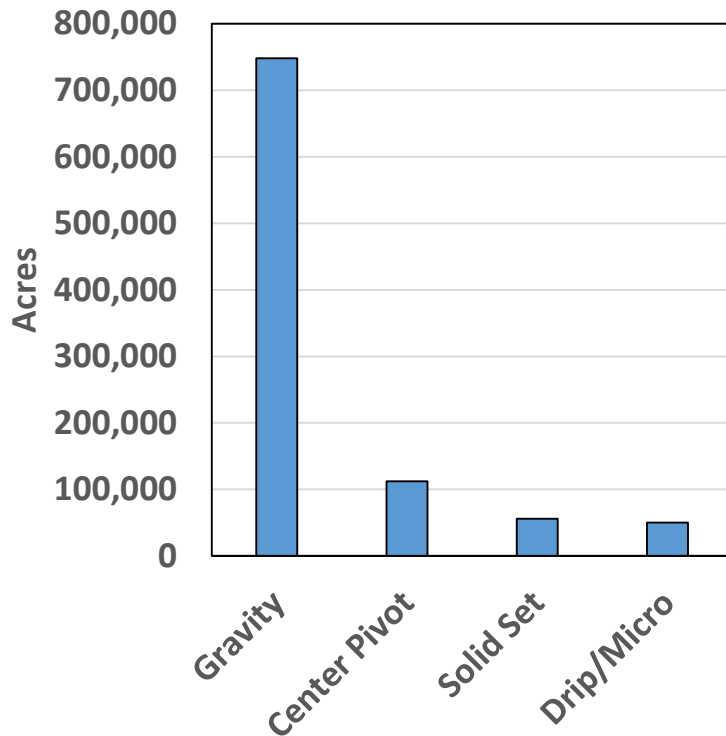


Young Pistachio Orchard

Nut trees have replaced cotton & alfalfa as a way to improve farm profitability in Southeast Arizona where problems with groundwater depletion are already severe. Studies are underway to quantify the water use of tree nuts in an effort to better understand the potential impacts on regional water use and to assist growers with irrigation management. Most new plantings use drip/micro-irrigation to apply water.

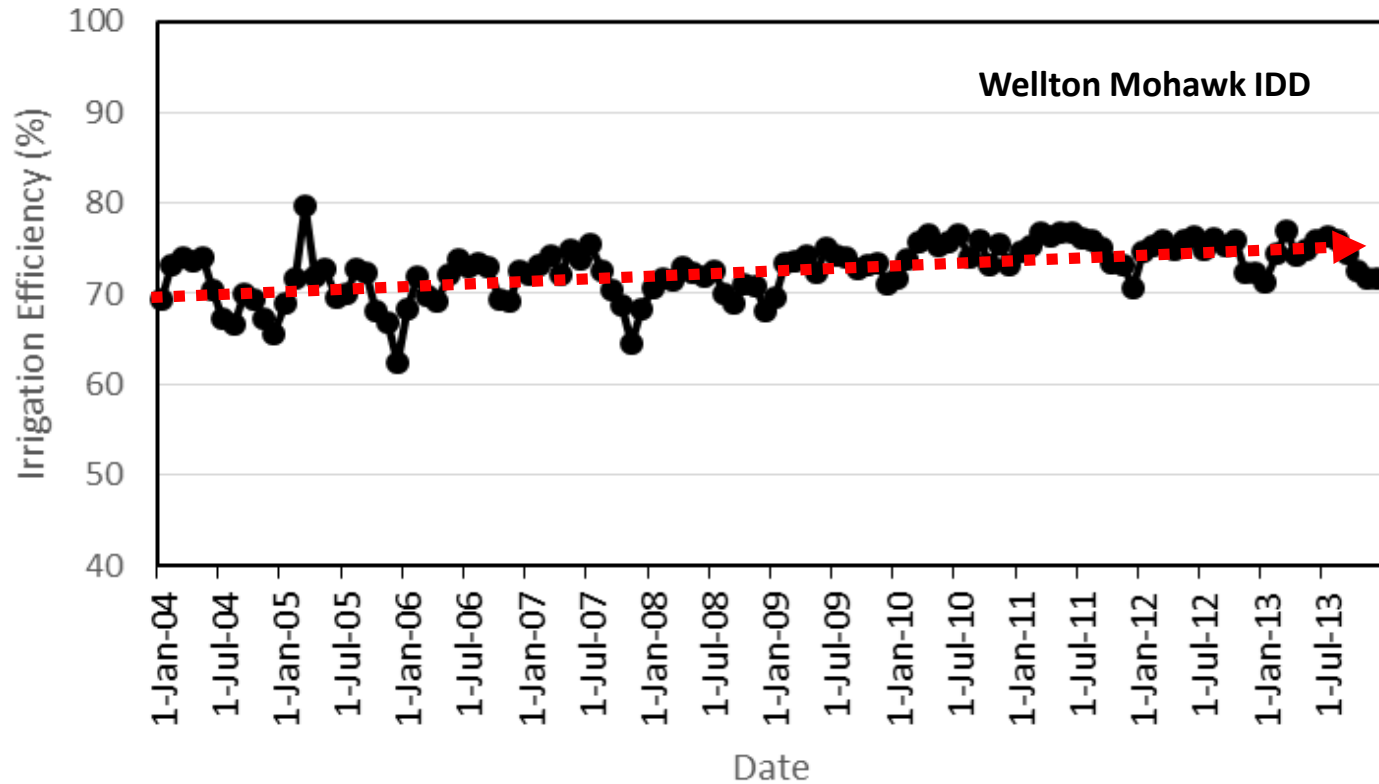
Arizona Irrigation Systems

Arizona Irrigation Systems: 2011

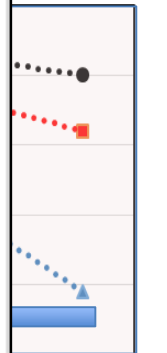


Improved Surface Irrigation Efficiency

Yuma County



ez et al. 2008



0 1000

with

Sprinkler Irrigation Trends

- **Center Pivots**
 - Improved efficiency
 - Automation, nozzle improvement
 - Precision technologies
 - Most popular in SE Arizona
 - Some replaced with micro-irrigation
 - Orchards & wine grapes
- **Solid Set**
 - Growing popularity in SW Arizona
 - Crop establishment
 - Wide bed produce
 - Wheat production



Subsurface Drip Irrigation

- **Regional Experience**

- **Row Crops**
 - Reduced Water Use
- **Forage Crops**
 - Similar Water Use
 - Improved Yields
- **Vegetables**
 - Limited Use
 - Germination
 - Salinity
 - Field Flexibility

- **Concerns**

- **Costs/Financing**
 - \$2500/a
- **Management**
- **Salinity**
 - Leaching Required
 - Maintain Surface System
 - Sprinklers During Establishment

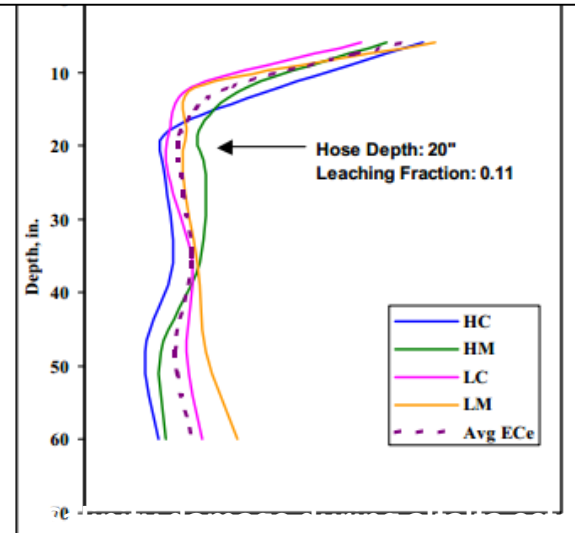
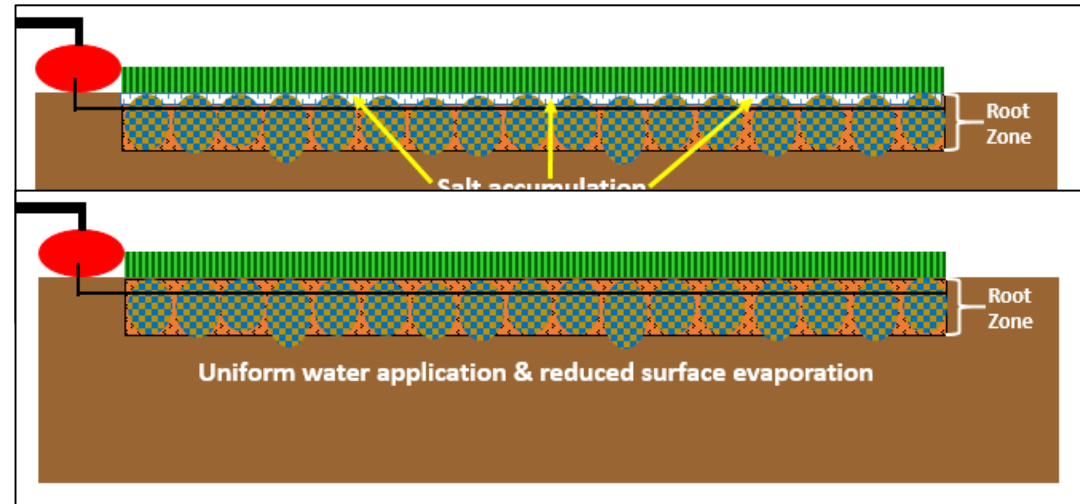
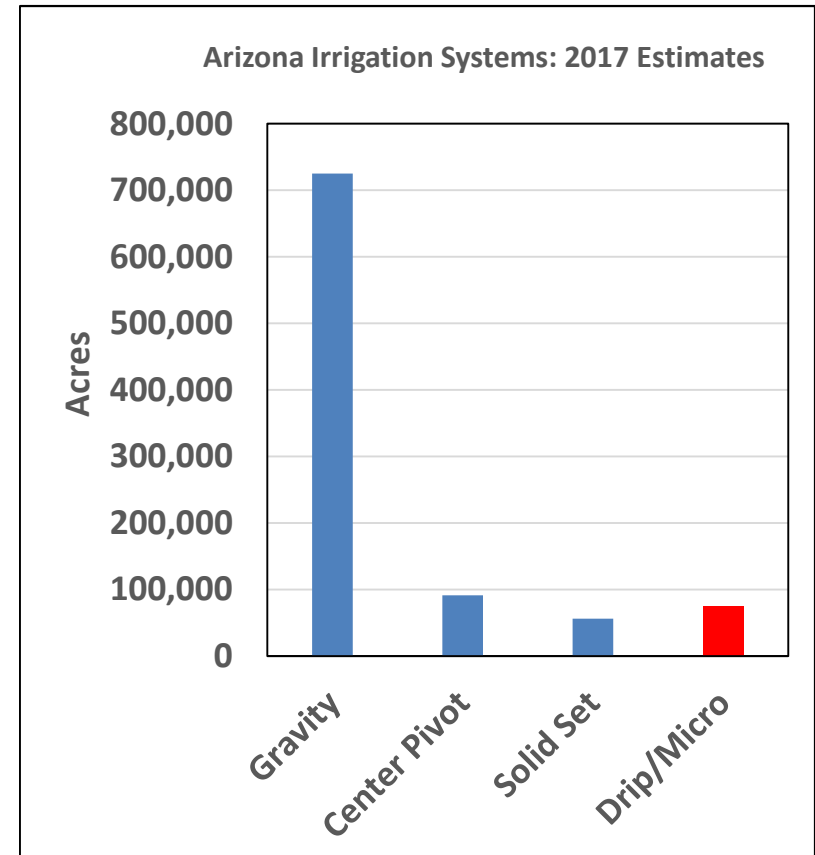


Figure 7. Change of ECe (dS/m) as a function of depth in inches in Field 1.

Subsurface Drip Irrigation

- **Increasing grower interest**
 - Lack of water/fear thereof
 - Yield enhancement
 - Labor
- **From Industry Sources**
 - **Last 5 years**
 - ~30,000 acres installed
 - **Statewide acreage**
 - ~75,000 acres
 - **Forage crops**
 - ~45,000 acres



Improving Irrigation Efficiency

Barriers

Barriers to Irrigation Improvements	Farms	Land (a)	Water (a-ft)
Landlord will not share costs	297	192,388 (23%)	919,114 (17%)
Improvement won't cover install. costs	560	124,760 (15%)	572,066 (11%)
Cannot finance improvements	1209	121,436 (14%)	519,227 (10%)
Will not be farming long enough	243	97,354 (10%)	520,142 (10%)
Uncertainty about water future	598	114,054 (13%)	443,406 (8%)

2013 Farm and Ranch Survey

Values in () represent % of irrigated land or % of ag water use

Remote Land Ownership

Financing

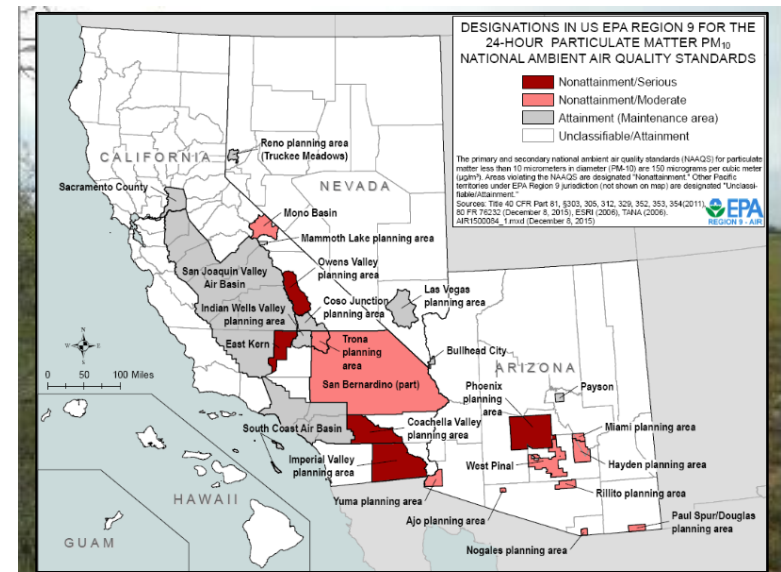
Urbanization/Age: 10%

Water Future

NRCS EQIP for irrigation improvements (since 1997): \$74 Million
NRCS EQIP for sprinkler/drip irrigation: \$42 Million on 182,000 acres

Abandonment

- May eliminate water use
- Re-vegetation
 - Slow/non-existent
 - No re-veg requirement
- Dust
 - Non-attainment
 - Dust storms
 - Serious traffic safety issue
- NRCS Plant Materials Center
 - Re-vegetation projects



The Future

- **Acreage Will Decrease**
 - Urbanization
 - Water issues
 - Urban valuation
 - Shortage/energy costs
- **Future Crop Production**
 - Vegetables/specialty crops
 - Forages
 - Strong tribal component
 - Shifting production seasons/areas
 - Warming
 - Lack of water
 - Technological advances
 - Water use efficiency
 - Stress & salinity tolerance

